

1 What is claimed is:

2 1. A mass spectrometer comprising:

3 an ionization source to produce ions;

4 a plurality of multipoles to cool, guide or select said

5 ions;

6 a collision surface for fragmenting said ions; and

7 a mass analyzer to analyze said ions.

8

9 2. A mass spectrometer according to claim 1, wherein said

10 ionization source is selected from the group consisting of

11 electrospray ionization source, nanospray ionization source,

12 microspray ionization source, matrix assisted laser

13 desorption/ionization, electron ionization, chemical ionization

14 and electron ionization.

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16 3. A mass spectrometer according to claim 1, wherein said

17 plurality of multipoles further comprise at least one quadrupole.

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1 4. A mass spectrometer according to claim 1, wherein a potential  
2 is applied between said ionization source and said collision  
3 surface to allow said ions to undergo surface induced  
4 dissociation.

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6 5. A mass spectrometer according to claim 1, wherein said mass  
7 analyzer is selected from the group consisting of time-of-flight  
8 (TOF) mass analyzer, fourier transform ion cyclotron resonance  
9 (FTICR) mass analyzer, quadrupole ion trap mass analyzer and  
10 coaxial multiple reflection TOF mass analyzer.

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12 6. A mass spectrometer according to claim 1, wherein a potential  
13 is applied between said ionization source and said collision  
14 surface such that said ions pass through all of said multipoles  
15 without colliding with said collision surface.

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17 7. A mass spectrometer according to claim 1, wherein said  
18 plurality of multipoles comprise first, second and third  
19 multipoles.  
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1 8. A mass spectrometer according to claim 7, wherein at least  
2 one of said first, second or third multipole comprises a  
3 quadrupole.  
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5 9. A mass spectrometer according to claim 7, wherein said first  
6 and second multipoles are arranged coaxially.  
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8 10. A mass spectrometer according to claim 7, wherein said  
9 collision surface is positioned between said second and third  
10 multipoles.  
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12 11. A mass spectrometer according to claim 7, wherein said  
13 collision surface is positioned at an angle to a co-axis of said  
14 first and second multipoles.  
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16 12. A mass spectrometer according to claim 7, wherein said first  
17 multipole collisionally cools said ions.  
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1 13. A mass spectrometer according to claim 7, wherein a  
2 potential is applied between said ionization source and said  
3 collision surface such that said ions pass through all of said  
4 multipoles without colliding with said collision surface.

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6 14. A mass spectrometer according to claim 7, wherein said third  
7 multipole contains a collision gas to fragment said ions.

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9 15. A mass spectrometer according to claim 7, wherein said first  
10 multipole selects ions of a predetermined m/z range, wherein a  
11 potential is applied between said ionization source and said  
12 collision surface such that said selected ions will not collide  
13 with said collision surface, and wherein said third multipole  
14 contains a collision gas to fragment said selected ions.

1 16. A mass spectrometer comprising:

2 an ionization source to produce ions;

3 first, second and third multipoles to cool, guide or

4 select said ions;

5 a collision surface for fragmenting said ions; and

6 a mass analyzer to analyze said ions;

7 wherein said first and second multipoles are arranged

8 coaxially;

9 wherein said collision surface is positioned between said  
10 second and third multipoles; and

11 wherein said collision surface is positioned at an angle to  
12 said axis of said first and second multipoles.

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14 17. A mass spectrometer according to claim 16, wherein at least  
15 one of said first, second or third multipole comprises a  
16 quadrupole.

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18 18. A mass spectrometer according to claim 16, wherein said  
19 first and second multipoles are arranged coaxially.

1 19. A mass spectrometer according to claim 16, wherein said  
2 collision surface is positioned between said second and third  
3 multipoles.

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5 20. A mass spectrometer according to claim 16, wherein said  
6 collision surface is positioned at an angle to a co-axis of said  
7 first and second multipoles.

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9 21. A mass spectrometer according to claim 16, wherein said  
10 first multipole collisionally cools said ions.

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12 22. A mass spectrometer according to claim 16, wherein a  
13 potential is applied between said ionization source and said  
14 collision surface such that said ions pass through all of said  
15 multipoles without colliding with said collision surface.

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17 23. A mass spectrometer according to claim 16, wherein said  
18 third multipole contains a collision gas to fragment said ions.

1 24. A mass spectrometer according to claim 16, wherein said  
2 first multipole selects ions of a predetermined m/z range,  
3 wherein a potential is applied between said ionization source and  
4 said collision surface such that said selected ions will not  
5 collide with said collision surface, and wherein said third  
6 multipole contains a collision gas to fragment said selected  
7 ions.

8  
9 25. A mass spectrometer according to claim 16, wherein said  
10 ionization source is selected from the group consisting of  
11 electrospray ionization source, nanospray ionization source,  
12 microspray ionization source, matrix assisted laser  
13 desorption/ionization, chemical ionization and electron  
14 ionization.

1 26. A mass spectrometer comprising:

2 at least one sample;

3 a source of laser radiation for producing ions from

4 said sample;

5 a plurality of multipoles to cool and guide said ions;

6 and

7 a mass analyzer to analyze said ions.

8  
9 27. A mass spectrometer according to claim 26, wherein said

10 ionization source is selected from the group consisting of

11 electrospray ionization source, nanospray ionization source,

12 microspray ionization source, matrix assisted laser

13 desorption/ionization, chemical ionization and electron

14 ionization.

15  
16 28. A mass spectrometer according to claim 26, wherein said

17 plurality of multipoles further comprise at least one quadrupole.



1 29. A mass spectrometer according to claim 26, wherein said mass  
2 analyzer is selected from the group consisting of time-of-flight  
3 (TOF) mass analyzer, fourier transform ion cyclotron resonance  
4 (FTICR) mass analyzer, quadrupole ion trap mass analyzer and  
5 coaxial multiple reflection TOF mass analyzer.  
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7 30. A mass spectrometer according to claim 26, wherein said  
8 plurality of multipoles comprise first, second and third  
9 multipoles.  
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11 31. A mass spectrometer according to claim 30, wherein at least  
12 one of said first, second or third multipole comprises a  
13 quadrupole.  
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15 32. A mass spectrometer according to claim 30, wherein said  
16 first and second multipoles are arranged coaxially.  
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18 33. A mass spectrometer according to claim 30, wherein said  
19 MALDI sample is positioned between said second and third  
20 multipoles.  
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1 34. A mass spectrometer according to claim 30, wherein said  
2 MALDI sample is positioned at an angle to a co-axis of said first  
3 and second multipoles.

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5 35. A mass spectrometer according to claim 30, wherein said  
6 third multipole contains a collision gas to fragment said ions.

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8 36. A Q-SID-Q-TOF mass spectrometer comprising:  
9 an ionization source to produce ions;  
10 a plurality of multipoles comprising at least one  
11 quadrupole;  
12 a collision surface for fragmenting said ions; and  
13 a time-of-flight mass analyzer to analyze said  
14 fragmented ions.

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16 37. A Q-SID-Q-TOF mass spectrometer according to claim 36,  
17 wherein said ionization source is selected from the group  
18 consisting of electrospray ionization source, nanospray  
19 ionization source, microspray ionization source, matrix assisted  
20 laser desorption/ionization, chemical ionization and electron  
21 ionization.

1 38. A Q-SID-Q-TOF mass spectrometer according to claim 36,  
2 wherein a potential is applied between said ionization source and  
3 said collision surface to allow said ions to undergo surface  
4 induced dissociation.

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6 39. A Q-SID-Q-TOF mass spectrometer according to claim 36,  
7 wherein a potential is applied between said ionization source and  
8 said collision surface such that said ions pass through all of  
9 said multipoles without colliding with said collision surface.

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11 40. A Q-SID-Q-TOF mass spectrometer according to claim 36,  
12 wherein said plurality of multipoles comprise one quadrupole and  
13 first and second multipoles.

14  
15 41. A Q-SID-Q-TOF mass spectrometer according to claim 40,  
16 wherein said first multipole and said quadrupole are arranged  
17 coaxially.

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19 42. A Q-SID-Q-TOF mass spectrometer according to claim 40,  
20 wherein said collision surface is positioned between said  
21 quadrupole and said second multipole.

1 43. A Q-SID-Q-TOF mass spectrometer according to claim 40,  
2 wherein said collision surface is positioned at an angle to a  
3 co-axis of said first multipole and said quadrupole.  
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5 44. A Q-SID-Q-TOF mass spectrometer according to claim 40,  
6 wherein said second multipole comprises a collision gas cell for  
7 collisionally cooling said fragmented ions.

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9 45. A Q-SID-Q-TOF mass spectrometer according to claim 40,  
10 wherein said first multipole collisionally cools said ions.  
11

12 46. A Q-SID-Q-TOF mass spectrometer according to claim 40,  
13 wherein a potential is applied between said ionization source and  
14 said collision surface such that said ions pass through all of  
15 said multipoles without colliding with said collision surface.  
16

17 47. A Q-SID-Q-TOF mass spectrometer according to claim 40,  
18 wherein said second multipole contains a collision gas to  
19 fragment said ions.  
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1 48. A Q-SID-Q-TOF mass spectrometer according to claim 40,  
2 wherein said first multipole selects ions of a predetermined m/z  
3 range, wherein a potential is applied between said ionization  
4 source and said collision surface such that said selected ions  
5 will not collide with said collision surface, and wherein said  
6 second multipole contains a collision gas to fragment said  
7 selected ions.